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Acknowledgements

The findings and methodology contained in this report were subject to review by the panel members listed below. Additionally, comments and suggestions were offered by the panel members to strengthen the body and conclusions of the report.

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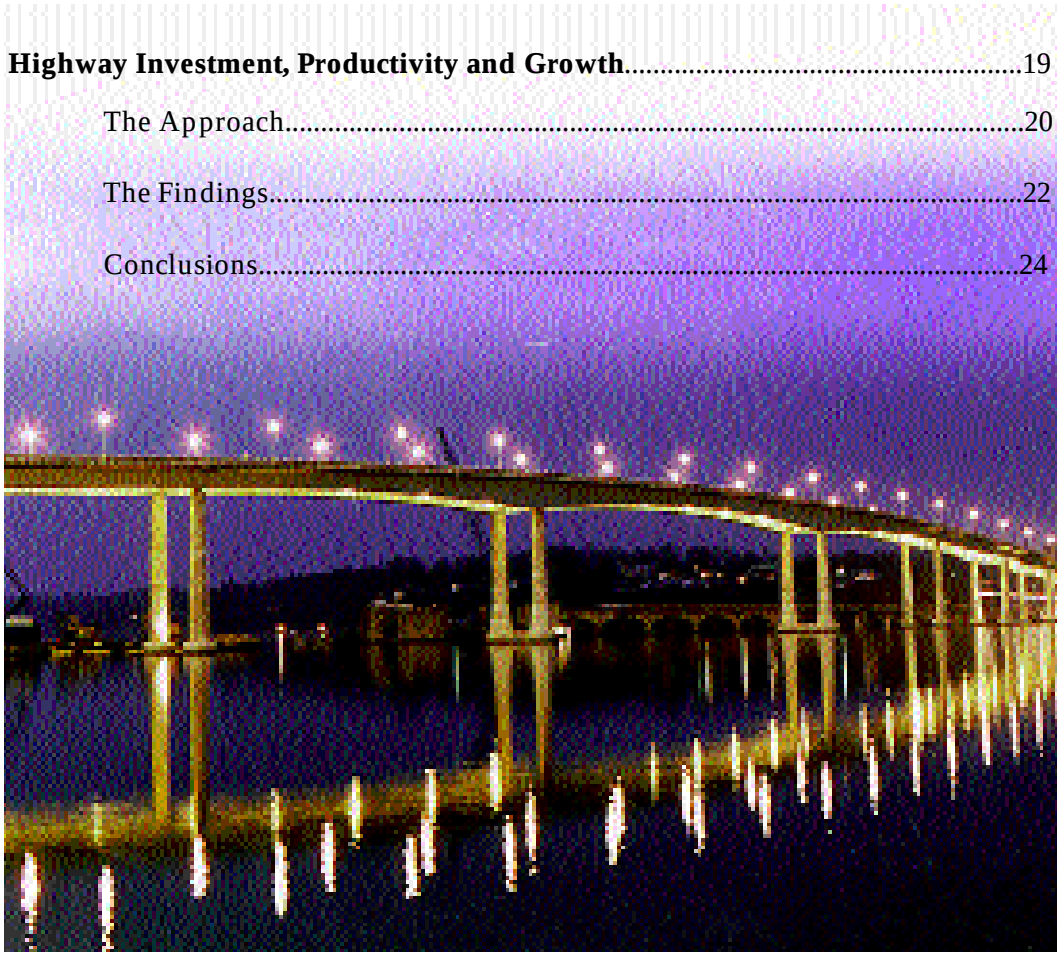
Contents



Introduction

This report summarizes the methods and findings of a new study of the economic effects of investing in Maryland's highway system, prepared for the Maryland State Highway Administration (SHA) by RESI of Towson University. The research has focused on highway spending's impact on the Maryland economy, although it also measures some benefits to Virginia, West Virginia, Washington DC, Pennsylvania, Delaware, and New Jersey; while earlier years enter into the analysis, the period 1991 to 1996 frames the study's central results.

The study considers two roles of highway spending in the state's economic life. On the one hand it measures the extent of that spending's influence on concurrent economic activity - the output and employment supported by the highway system via its demand for the labor, goods, and services of Maryland workers and firms. An input-output model specifies this current spending impact for 1991-1996 for Maryland and its neighbors, then breaks it down by industries, and finally compares it across types of spending.

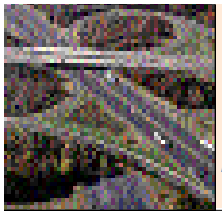
Apart from its association with current economic activity, highway spending also marks an investment in growth. An expanded and improved highway system allows private firms to produce more output with given private inputs, as transportation efficiencies release workers and equipment for other contributions to production. The study's second aim is to identify this long-run productivity effect and its role in economic growth. Cost functions estimated for nine major industries give the cost savings associated with highway investments. Summed across the economy, these private benefits define the public's rate of return on its highway outlays, and the associated productivity increases are that investment's contribution to economic growth.

Organization of This Report

In its first section, the report presents a method for measuring the current impact of highway spending, followed by a summary of its main findings. A second section turns to the productivity and growth effects, again explaining the analytical approach before detailing key results.

A separate technical appendix that fully details the methodology and data is available by request.

EXECUTIVE SUMMARY



Executive Summary

Investment in Maryland's highway system helps to assure the continued free flow of people and goods throughout the state. Although the benefits of the highway system seem obvious, the specific ways in which highways support and enhance Maryland's economy are not well documented. RESI's comprehensive study of the Maryland State Highway Administration's (SHA) ongoing investment in the state's highway system seeks to answer the following questions.

* **Why should the State of Maryland invest in its highway system?**

* **What short-term economic benefits flow from these investments?**

* **How does highway investment affect the economy in the longer term?**

Highway investments deliver broad, substantial, and lasting benefits to the state's economy. Short-term benefits accrue directly from monies spent to improve and maintain Maryland's highways. These expenditures support economic activity and employment at SHAand firms in the state through purchases of labor, goods, and services. In the longer term, investments in the highway system help create a more efficient economy by reducing the costs of producing goods and services. This long-term effect fosters economic growth that helps expand the state's economy and build a better economic life for all Marylanders. Figure 1 illustrates these two effects of SHA expenditures on Maryland's economy.

Figure 1:

Economic Effects of SHA Highway Investments

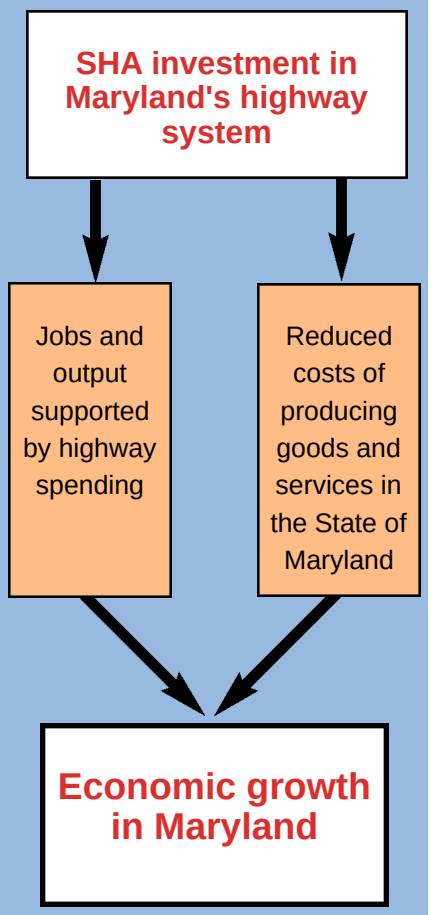
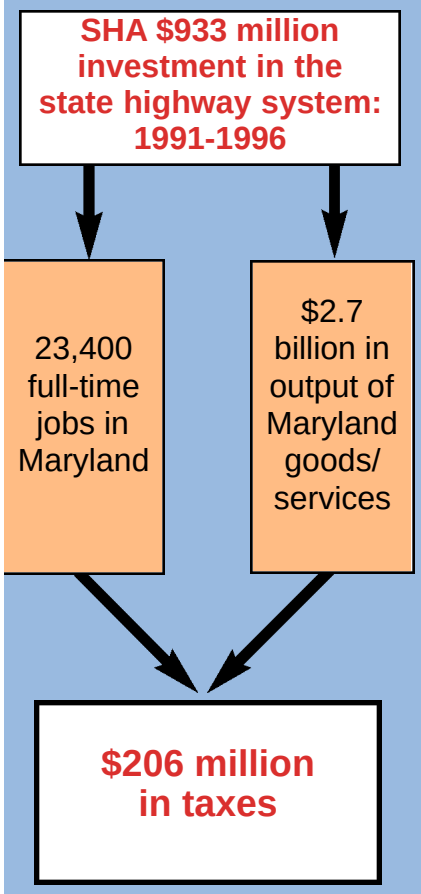


Figure 2:

Direct and Indirect Annual Impacts of SHA Highway Investments

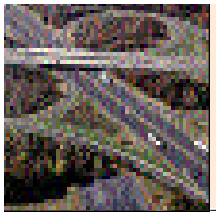


First and most directly, SHA's highway investments support economic activity by creating demand for the labor, goods, and services needed to build and service the state's highway system. In meeting this demand, government and the private sector employ workers and generate income and output, starting with the direct activity of SHAand its contractors. SHA suppliers create additional impacts by their expenditures on materials and services to support their highway construction and maintenance activities. This additional spending helps to create a multiplier effect in Maryland by recirculating SHA's original expenditures to Maryland businesses as well as to out-of-state firms. Finally, the employees of all these public and private entities create added economic activity by spending their wages and salaries for goods and services in Maryland as well as in other states surrounding Maryland. By doing all these things, SHA helps to create economic growth which in turn helps to generate new tax revenues for Maryland.

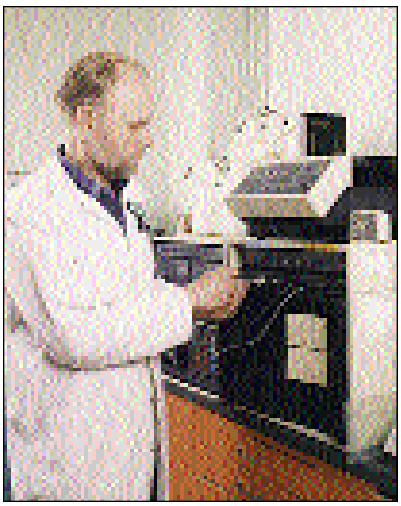
Between 1991 and 1996, SHAhighway construction and maintenance expenditures averaged $933 million per year. As shown in Figure 2, each year, these expenditures have supported

* 23,400 full-time jobs in Maryland,
* $2.7 billion in the state's output of goods and services, respectively 1.2 and 2.0 percent of Maryland's total jobs and output, and
* $206 million in tax revenue including $40 million in state and local income taxes, $96 in million in sales taxes, and $70 million in federal payroll taxes.

Besides sustaining economic activity through the direct demand for labor, goods, and services, highway investments make new activity possible by raising the efficiency of production.



...and promote efficiency tomorrow ...



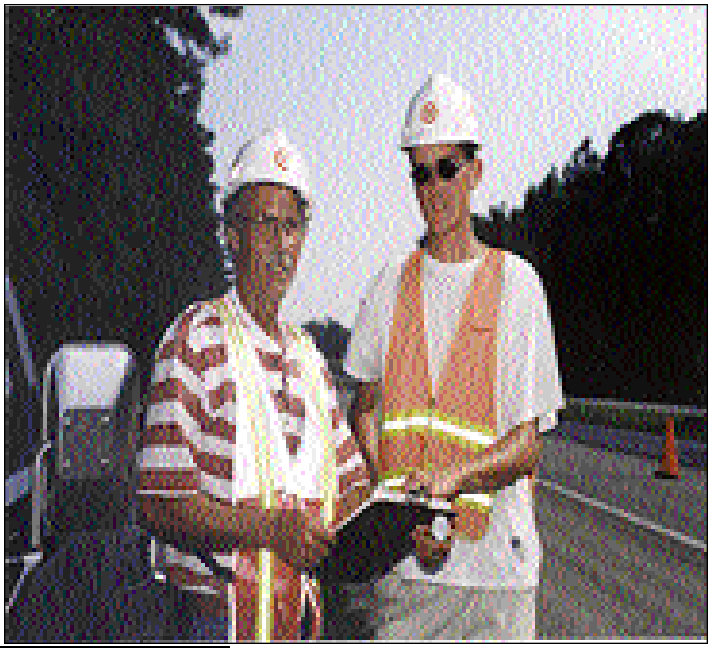
An expanded and improved highway system helps firms to do more with less by delivering higher quality, less expensive, and faster transportation services. These improved transportation services free up workers, equipment, and capital which can then be used to add value elsewhere in the production process. In a first-ever estimate of the productive return to Maryland highway spending, this study finds that the average dollar spent by Maryland on highways between 1982 and 1996 reduced private industry costs by 17 cents. By reducing costs of producing goods and services, this investment helps the state's businesses to grow. The productivity impacts of the state's highway investments include:

• The annual rate of return on highway spending is 17 percent. Maryland's spending on highways between 1982 and 1996 caused yearly private costs of production to fall an average 17 cents per original dollar spent on highway investment.

• The cost savings due to highway investment are concentrated in the manufacturing sector, where an average highway dollar reduced annual production costs by more than 12 cents.

• Highway investment is responsible for 10 percent of average annual growth in total factor productivity in Maryland between 1982 and 1997.

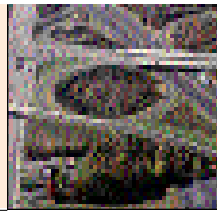
• The productive effects of highway investment explain 4 percent of Maryland's total economic growth in the last fifteen years.



These impacts all serve to stimulate economic growth in Maryland. One result of this growth is increased revenues for the state, another is the return on SHA's investment in the state highway system. The relationship between highway investment and economic growth is outlined in Figure 3.

The Economic Impact of Maryland Highway Investment

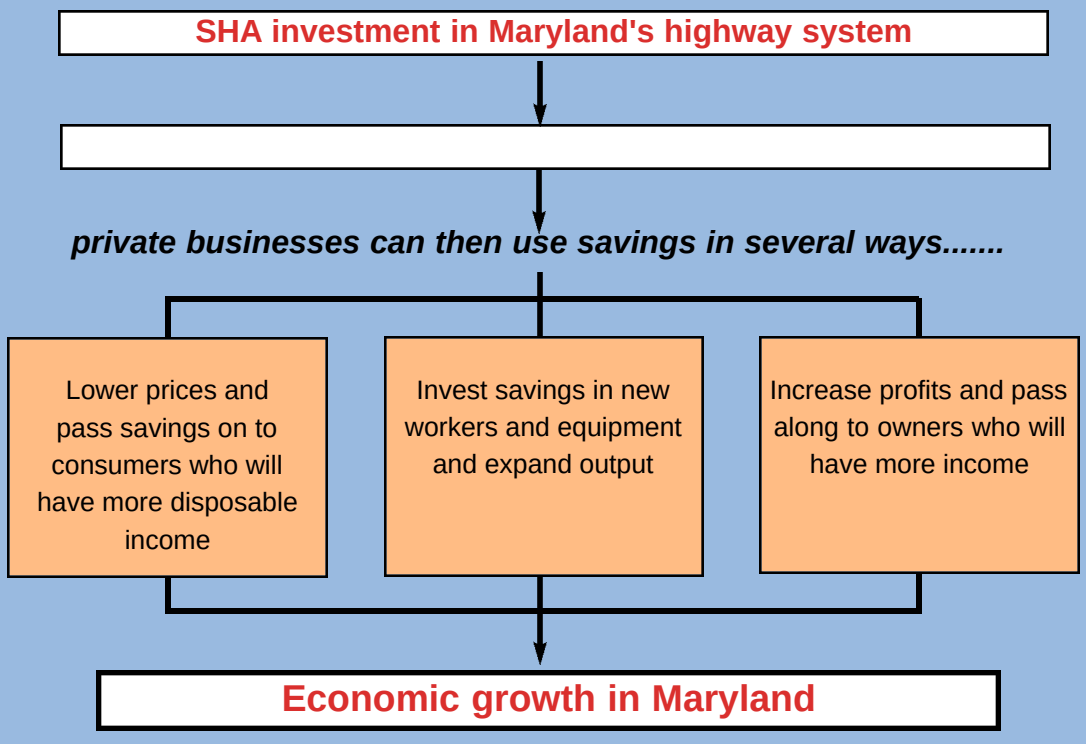
...assuring a key role for highway investment in present and future prosperity.

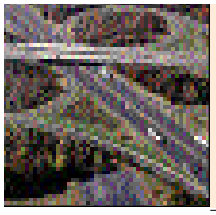


RESI's analysis excludes many other benefits of highway infrastructure. While more difficult to measure, reduced congestion and greater personal mobility are economic benefits that also contribute to Maryland's economy. Additionally, increased economic development can be linked to continued highway investment. Highway investment also leads to safer roads, which reduce injuries and fatalities. Increased safety is yet another economic benefit. By excluding these and other types of economic impacts this analysis underestimates the total impact of SHA's investments. This makes all the more remarkable the large benefits addressed by the study's narrow scope.

Figure 3:

SHA Highway Investments, Productivity, and Economic Growth





The impacts addressed by RESI's analysis are central to Maryland's economic well being. Highway spending supports fully 2 percent of total economic activity, widely dispersed across industries and regions. In other words, one dollar in every $50 of economic activity in Maryland-sales of goods and services-is supported by SHAexpenditures on highways. Similarly, the 23,400 full-time jobs supported by SHA spending means that one in every 80 jobs in the state depends on SHA spending.

The impact of SHAhighway investments on the productivity of Maryland's private sector is remarkable. At 17 percent, the productive return on highway investments by the state exceeds the average return to private capital, which Nadiri and Mamuneas (1997) using similar methods for a comparable period have estimated at 10 percent. Their finding of 15 percent return on US highway investment over a comparable period puts this in the same neighborhood as the Maryland return reported here.

The overall magnitude of these effects invites attention to their details - how individual industries share the benefit, and the importance of different types of projects. Not easily summarized here, treatment of these topics in the body of this report should help policymakers to fulfill the economic potential of public investment.

CURRENT OUTPUT AND EMPLOYMENT EFFECTS OF HIGHWAY SPENDING

The Approach

To capture the economic activity associated with highway spending through its purchases of labor, goods, and services from workers and firms in Maryland, the analysis proceeds in two steps. (See the appendix under separate cover for a more detailed explanation of the methodology).

An input-output model of the regional economy traces each dollar spent on highways from SHA's immediate vendors and employees to spending by their workers and suppliers, and from there as far upstream as needed. A comparison of the state's total economic output with and without the highway spending gives the same-year output effect. The same-year employment effect is the number of jobs associated with this extra economic activity. Both types of effect are compared across industries and categories of spending.

SHA expenditures are first broken down by the Standard Industry Classification of the agency's vendors and fed into an input-output model of the Maryland economy. That model is a matrix specifying for any good or service x, the amounts of other goods and services involved in producing one unit of x. The matrix makes it possible to trace the effect of SHAspending "upstream" through the economy. Each dollar disbursed to a construction firm, for example, is traced through the construction industry's characteristic purchases of materials, machinery, etc. from other industries, whose purchases in turn represent a further layer of impact. An initial measure of highway spending's output effect on a given industry is simply the sum of all

purchases of that industry's product connected to the original spending via these purchasing relationships between industries. (One complication is that Maryland firms buy from and sell to firms outside the state. Interindustry flows are for this reason adjusted by the ratio of an industry's Maryland-bound spending to its total spending.)

The input-output model cannot tell the whole story by itself. The simple relationships of interindustry demand which it captures are far from the only form of interdependence relevant to highway spending effects. A macroeconomic model of the regional economy allows the historical relationships among industry flows to interact with the specific shifts introduced by the input-output simulation of expenditure impacts. Drawing on RESI's established model of the Maryland economy, the study estimated a series of equations for industry employment and output together with various components of income and population (see appendix). The resulting equations embody various linkages across industries and between income and product components. The second stage of simulating highway expenditure impacts was then to introduce the initial set of output shocks generated by the input-output model into this macro model's output equations. The final output impact of highway spending is the difference between the macro model's value for total output with and without that set of shocks; the equivalent difference for employment supplies the job impact. The payroll supported by SHAspending is calculated as this employment impact multiplied by average industry wages. A tax-revenue impact is estimated by multiplying the changes in personal income, sales, and wages by average effective rates of income, sales, and payroll taxation. Finally, the impacts of different types of spending are compared by performing an identical simulation for each component including spillover effects into other states of the region are presented in the appendix.

The Findings

Table 1 summarizes the one-digit input and employment impacts of current SHAspending. The first column gives the gross sectoral output associated with one dollar of highway spending. The jobs supported by $1 million in SHA

Table 1:
SHA-Supported Output and Employment Per Unit of Highway Spending

Sector	Output/$	Job/Million $'s
Agriculture	2.44	16.46
Construction	2.83	36.27
Manufacturing	2.60	20.38
Transportation, Communication, and Utilities	2.88	9.25
Retail and Wholesale Trade	3.45	66.80
Finance, Insurance, and Real Estate	1.38	1.37
Services	3.40	96.03
Government	2.45	2.54
All Sectors	**2.93**	**25.0**

expenditures are reported in the second column. An industry's gross output includes the value it acquired in all previous stages of its production. Large multipliers for industries like trade and services reflect their downstream position in the economy. Government output here includes the direct activity of SHA, as well as any production activity it commissions from other government agencies. Table 1 was constructed by dividing the sector's output and employment by SHA expenditures in the corresponding sector.

The output and job multipliers for all sectors represents a weighted average of the spending and output generated in each of the major industrial classifications. Therefore it is not possible to add the individual major industries to get a total multiplier value. Moreover, the reported federal highway multiplier of 42 jobs per million is higher than the total

Table 2:
Maryland Economic Output Supported by SHA Expenditures
(*Millions of 1996 Dollars)*

	1991	1992	1993	1994	1995	1996	Average
Agriculture	25.28	18.35	18.40	14.99	23.39	30.00	21.74
Mining	3.20	1.87	2.63	2.62	2.64	3.43	2.73
Construction	1,197.42	867.17	869.65	891.97	1,051.40	1,282.77	1,026.73
Manufacturing	124.82	89.98	106.84	93.79	106.21	115.37	106.17
Durable Manufacturing	83.67	61.18	74.08	64.40	73.62	67.09	70.67
Non-Durable Manufacturing	41.15	28.80	32.77	29.39	32.59	48.29	35.50
Transportation, Communications, and Utilities	140.90	104.35	100.73	120.58	142.40	155.09	127.34
Transportation	40.22	30.04	28.60	30.79	36.70	51.47	36.30
Utilities	100.68	74.31	72.12	89.79	105.69	103.62	91.04
Wholesale and Retail trade	402.00	299.14	237.19	488.04	331.72	374.19	355.38
Wholesale Trade	290.81	215.40	152.83	403.53	235.57	248.04	257.70
Retail Trade	111.19	83.74	84.36	84.51	96.15	126.14	97.68
Finance, Insurance, and Real Estate	72.53	53.11	67.40	48.89	62.09	73.12	62.86
Services	262.43	187.19	188.43	204.19	227.99	247.87	219.68
Government	729.74	709.33	752.08	830.76	898.49	976.14	816.09
All Sectors	2,958.32	2,330.48	2,343.35	2,695.83	2,846.33	3,258.00	2,738.72

Table 3 :
Percent of Industry Output Supported by SHA Expenditures

	1991	1992	1993	1994	1995	1996	Average
Agriculture	1.97%	1.41%	1.50%	1.17%	1.83%	2.36%	1.71%
Mining	2.39%	1.62%	2.37%	2.23%	2.25%	2.93%	2.30%
Construction	16.23%	13.15%	13.20%	12.90%	15.53%	19.38%	15.07%
Manufacturing	0.98%	0.76%	0.91%	0.77%	0.89%	0.99%	0.88%
Durable Manufacturing	1.32%	1.08%	1.35%	1.07%	1.24%	1.15%	1.20%
Non-Durable Manufacturing	0.65%	0.47%	0.52%	0.48%	0.55%	0.83%	0.58%
Transportation, Communication and Utilities	1.31%	1.01%	0.92%	1.02%	1.21%	1.32%	1.13%
Transportation	1.35%	1.07%	0.97%	0.99%	1.18%	1.67%	1.20%
Utilities	1.29%	0.98%	0.90%	1.03%	1.22%	1.20%	1.10%
Wholesale and Retail trade	1.98%	1.47%	1.17%	2.31%	1.58%	1.79%	1.71%
Wholesale Trade	3.59%	2.67%	1.86%	4.65%	2.72%	2.87%	3.06%
Retail Trade	0.91%	0.68%	0.70%	0.68%	0.78%	1.03%	0.79%
Finance, Insurance, and Real Estate	0.26%	0.19%	0.23%	0.16%	0.20%	0.24%	0.21%
Services	0.91%	0.63%	0.62%	0.65%	0.73%	0.79%	0.72%
Government	2.98%	2.92%	3.07%	3.34%	3.18%	3.06%	3.09%
All Sectors	2.21%	1.75%	1.73%	1.92%	1.99%	2.23%	1.97%

Table 4:
Employment Supported by SHA Expenditures

	1991	1992	1993	1994	1995	1996	Average
Agriculture	129	80	85	69	99	130	99
Mining	32	21	22	25	24	25	25
Construction	11,055	7,878	8,286	7,441	8,768	9,701	8,855
Manufacturing	769	561	528	454	531	585	571
Durable Manufacturing	535	389	367	308	366	391	393
Non-Durable Manufacturing	234	172	161	146	164	195	179
Transportation, Communications, and Utilities	324	248	256	230	277	329	277
Transportation	317	241	250	225	271	322	271
Utilities	7	7	6	4	6	7	6
Wholesale and Retail trade	5,952	4,408	4,514	4,051	4,771	5,480	4,863
Wholesale Trade	56	97	80	127	95	103	106
Retail Trade	5,816	4,311	4,434	3,924	4,676	5,377	4,756
Finance, Insurance, and Real Estate	56	46	37	33	38	45	43
Services	5,094	3,792	3,406	4,124	4,148	4,499	4,177
Government (Non-SHA)	562	619	589	513	584	600	578
Government (SHA)	4,152	4,033	3,913	3,937	3,886	3,711	3,939
All Sectors	28,124	21,685	21,636	20,876	23,127	25,105	23,426

Table 5:
Percent of Employment Supported by SHA Expenditures

	1991	1992	1993	1994	1995	1996	Average
Agriculture	0.75%	0.48%	0.48%	0.37%	0.53%	0.67%	0.55%
Mining	2.07%	1.82%	1.95%	2.43%	2.13%	2.17%	2.10%
Construction	8.49%	6.57%	6.85%	5.90%	6.89%	7.41%	7.02%
Manufacturing	0.40%	0.31%	0.29%	0.25%	0.30%	0.34%	0.32%
Durable Manufacturing	0.54%	0.43%	0.42%	0.35%	0.43%	0.46%	0.44%
Non-Durable Manufacturing	0.25%	0.19%	0.17%	0.16%	0.18%	0.22%	0.20%
Transportation, Communication and Utilities	0.33%	0.26%	0.27%	0.23%	0.27%	0.32%	0.28%
Transportation	0.61%	0.47%	0.48%	0.40%	0.48%	0.56%	0.50%
Utilities	0.02%	0.02%	0.01%	0.01%	0.01%	0.02%	0.01%
Wholesale and Retail trade	1.17%	0.87%	0.90%	0.79%	0.90%	1.03%	0.94%
Wholesale Trade	0.13%	0.09%	0.08%	0.12%	0.09%	0.10%	0.10%
Retail Trade	1.44%	1.08%	1.11%	0.95%	1.11%	1.27%	1.16%
Finance, Insurance, and Real Estate	0.04%	0.04%	0.03%	0.02%	0.03%	0.03%	0.03%
Services	0.88%	0.64%	0.55%	0.65%	0.63%	0.66%	0.67%
Government	1.68%	1.67%	1.59%	1.55%	1.53%	1.47%	1.58%
Average of All Sectors	1.45%	1.13%	1.11%	1.05%	1.14%	1.22%	1.18%

Tables 4 and 5 report the employment sustained by SHA expenditures. SHA expenditures supported 1.2% of all jobs in Maryland over the last six years.

Table 6 presents the payroll supported by SHA expenditures, i.e. the sum for each industry of wages and salaries corresponding to the employment supported by highway spending.

employment multiplier reported here, this is primarily due to the leakage of expenditures and jobs into the surrounding region.

Tables 2 and 3 (see page 15) report the annual level of output supported by SHA expenditures in levels and as percentage of the sector's output. Overall, the output associated with highway spending accounted for an average 2.0% of Maryland's output between 1991 and 1996. The output effects reported are larger than the corresponding employment effects due in part to the capital intensive nature of highway construction.

Table 6:
Wages and Salaries Supported by SHA
(Millions of 1996 Dollars)

	1991	1992	1993	1994	1995	1996	Average
Agriculture	2.47	1.58	1.70	1.43	2.08	2.86	2.02
Mining	1.13	0.77	0.83	0.97	0.96	1.02	0.95
Construction	343.29	249.02	263.08	240.51	292.09	339.04	287.84
Manufacturing	27.39	20.98	20.07	18.03	21.80	25.08	22.23
Durable Manufacturing	21.16	16.10	15.42	13.69	16.76	18.49	16.94
Non-Durable Manufacturing	7.37	5.75	5.51	5.14	6.01	7.50	6.21
Transportation, Communications, and Utilities	11.63	9.29	9.83	9.11	11.06	13.66	10.76
Transportation	11.37	9.03	9.61	8.93	10.81	13.38	10.52
Utilities	0.24	0.27	0.24	0.15	0.26	0.31	0.25
Wholesale and Retail trade	216.67	168.64	179.04	162.70	198.06	240.27	194.23
Wholesale Trade	2.23	1.67	1.37	2.23	1.70	1.90	1.85
Retail Trade	214.44	166.97	177.66	160.46	196.37	238.37	192.38
Finance, Insurance and Real Estate	1.84	1.71	1.46	1.30	1.56	1.96	1.64
Services	142.12	111.69	102.67	127.11	132.34	149.46	127.57
Government	151.63	147.19	147.91	146.09	151.31	160.54	150.78
All Sectors	899.28	711.76	727.47	708.01	812.23	934.83	798.93

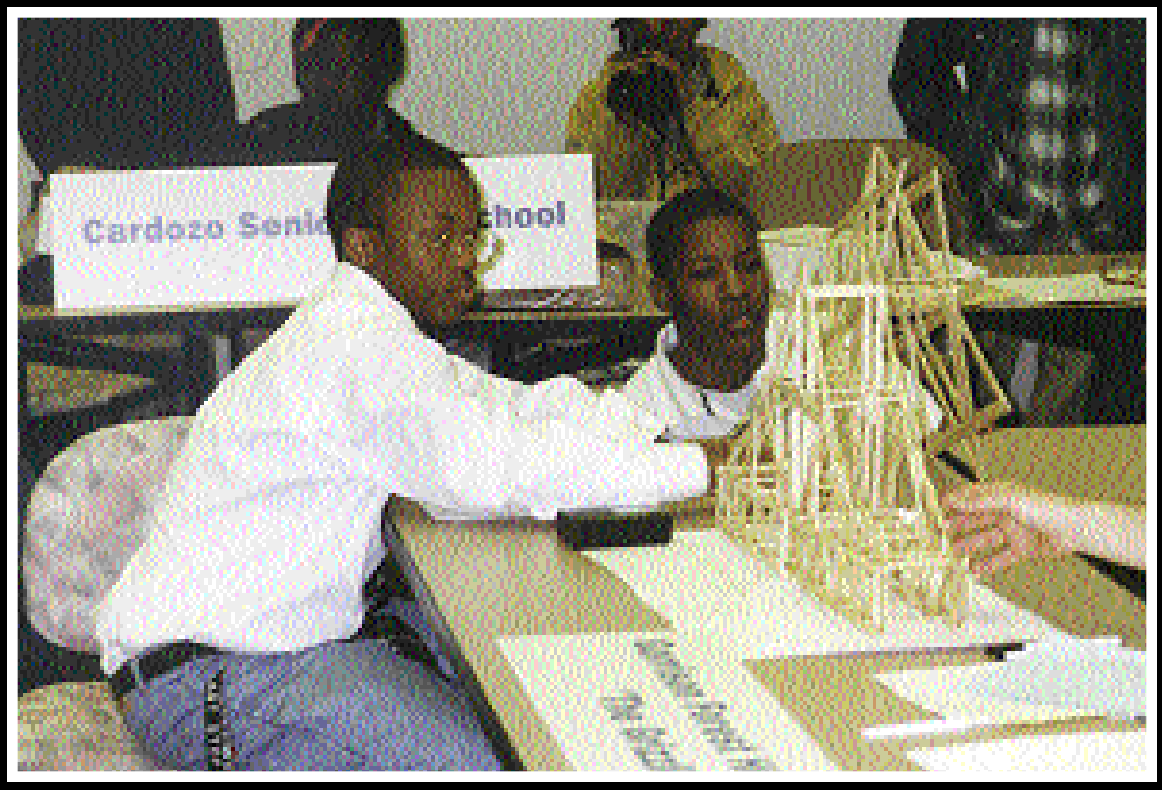
The personal income, sales, and payroll associated with highway spending generated over $206.4 million per year in tax revenue for the state, including $40.6 million in income taxes, sales taxes of $96.1 million, and $69.7 million from the payroll tax. Table 7 presents these effects on an annual basis. Payroll taxes are the social security taxes firms pay while income taxes include local, state and federal taxes borne by employees.

Table 7 :
Local, State and Federal Taxes Supported by SHA Expenditures
(Millions of 1996 Dollars)

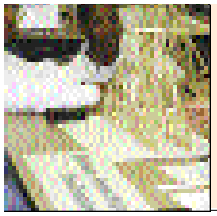
Form of Tax	1991	1992	1993	1994	1995	1996	Average
Local and State Income	45.68	36.16	36.95	35.97	41.26	47.49	40.58
Federal Payroll	78.44	62.08	63.45	61.76	70.85	81.54	69.69
State Sales	111.43	81.06	79.56	93.25	97.39	114.09	96.13

Finally, the impacts of nine categories of spending are separately calculated and presented in Appendix 1, while the second appendix gives the output and employment effects of Maryland highway spending on the economies of Virginia, West Virginia, Washington, D.C., Pennsylvania, Delaware, and New Jersey.

The construction and government sectors account for the majority of same-year output and employment impacts from highway spending. Thirty-seven percent of the output effect and 38 percent of the job impact fall in construction, while the government sector accounts for 30 and 19 percent of the output and job impacts, respectively. Construction's benefit derives from its position as the agency's leading vendor. The trade multiplier likewise reflects the role of wholesalers in supplying SHA and its contractors. While manufacturing's gains were heaviest among the suppliers of construction supplies, a majority of the impact reflected purchases further upstream.

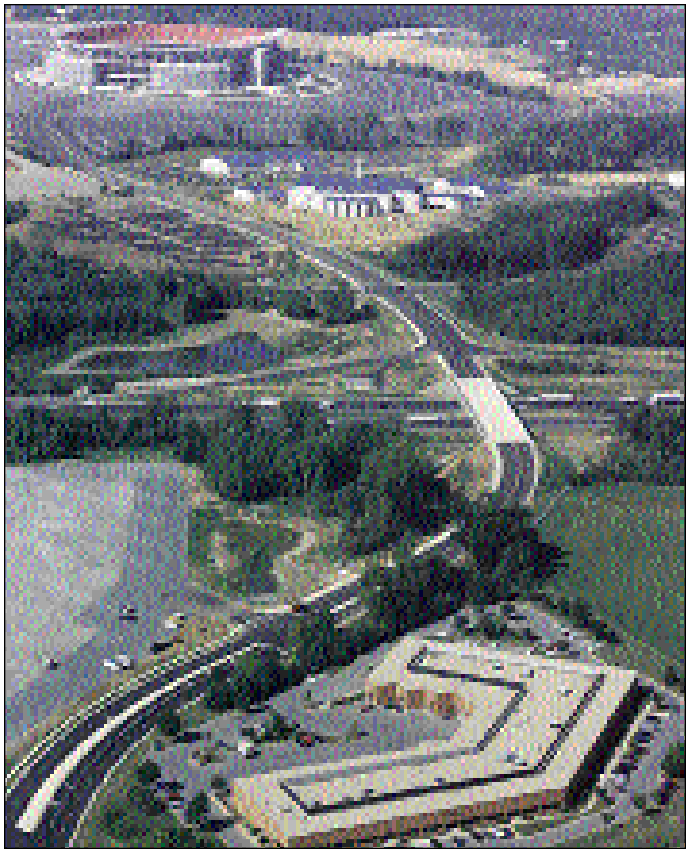


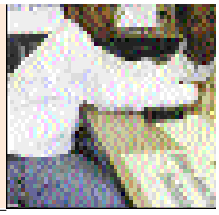
HIGHWAY INVESTMENT, PRODUCTIVITY, AND GROWTH



The Approach

Economic growth occurs when new workers and machines join the productive process. But the question of how much people can accomplish with their tools is crucial, too. Known as productivity growth, a rise in the amount of output produced with given inputs is the key to highway investment's second economic role. This study finds that the growth of Maryland's workforce and the expansion of its private capital stock account for 56 percent of its economic growth between 1982 and 1996. The remaining half of growth is productivity growth, traditionally credited to the onset of more powerful technologies and a better organization of firms. The analysis offered here inserts a new face among these "usual suspects"- it finds that highway investments are responsible for almost 10 percent of productivity growth.

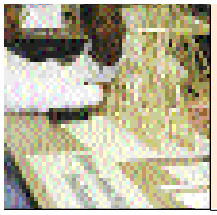




Every increase in productivity shows up on firms' balance sheets, as a reduction in what they must spend to produce a unit of what they sell. So the study analyzes highways' productive contribution by examining how costs in each of nine major industries change over time. Econometric techniques make it possible to separate the effects of wage increases or the changing prices of capital goods from the influence of other factors. Among such additional factors, highway investment offers substantial savings. The public's annual rate of return on its highway investment is the sum of such industry savings per dollar of spending.

While sustaining economic activity through their demand for labor and private goods, highway investments make new activity possible by raising the efficiency of production. An expanded and improved highway system helps firms to do more with less, as faster transportation frees up workers and equipment for adding value elsewhere in the process. If economic growth is understood as a joint process of increasing the inputs available to production and increasing the amount of output produced with given inputs, the growth effect of highway investment consists in its contribution to that second process, or productivity growth.

For reasons detailed in the appendix, this study uses industry cost functions to capture this effect. For each of nine major industries, total annual industry labor and capital costs are taken as a function of wages, the effective price of capital goods, time standing in for general technical progress, and the stock of highway capital in place throughout the year. The appendix details the sources and calculations employed to yield these series of data. As also explained in that appendix, it is possible to derive from each cost function two equations giving the industry's demand for labor and capital, also in terms of wages,



capital prices, time, and the highway stock; these factor demand equations are estimated together with the cost function for the period 1982 to 1996.

Estimated coefficients on these equations' highway-stock terms give the change in industry costs due to a unit's increase in the assessed value of the highway system. Where this change is negative, highway investment is responsible for private savings. An industry benefits from highway spending in proportion to these savings, and the social gain from highway spending is the sum of these savings across the economy. By expressing the savings per dollar of highway investment, the approach also gives an annual rate of return on that investment - annual because the savings represent a permanent reduction in yearly costs of production.

The appendix explains how standard economic theory makes it possible to derive a growth effect from the highway investment cost effect calculated in this way. The relationship between cost and highways and the relationship between cost and output - both given by the estimated cost function - together determine a relationship between output and highways. The approach thus specifies how an industry's output responds to a unit increase in the highway stock. When multiplied by actual highway investment, this number gives highways' contribution to growth. This contribution, a component of total productivity growth, is compared to other growth components to further indicate the relative importance of highway investment.

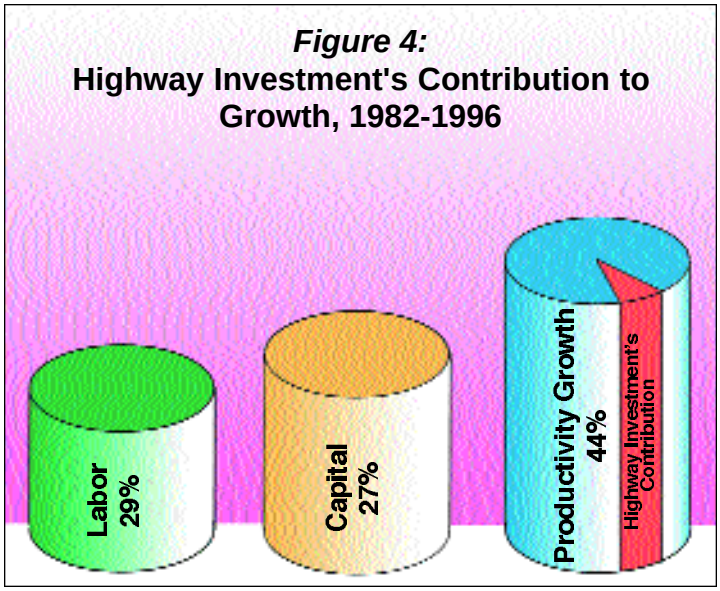
The Findings

Cost-function estimates for Maryland industries between 1982 and 1996 show that highway investment caused substantial reductions in private costs of production. By 1996 that investment had reduced the annual wage and capital cost bill by $1 billion, or 3 percent of total costs in 1982. On average during those years, a one percent increase in the stock of highway capital resulted in a quite significant 0.05 percent decrease in industry costs.

Expressed on a per-highway-dollar basis, these savings indicate the return to highway investments. An average dollar spent on highways reduced annual industry costs by 17 cents, indicating a 17 percent annual public return on such investment; the permanent reduction in private costs means that each year the investment continues to provide a 17 percent return on the initial investment.

Such savings vary widely across industries, reflecting differences in their demand for highway services. Most of the savings were concentrated in manufacturing which realized a 12 cent savings per dollar of highway investment. The balance of industries accounted for the remaining savings per dollar of highway investment.

As explained in the appendix, the cost effects of highway investment are limited to a set of output effects. During the period of the study a one percent increase in the highway stock caused a 0.06 percent increase in economic output.



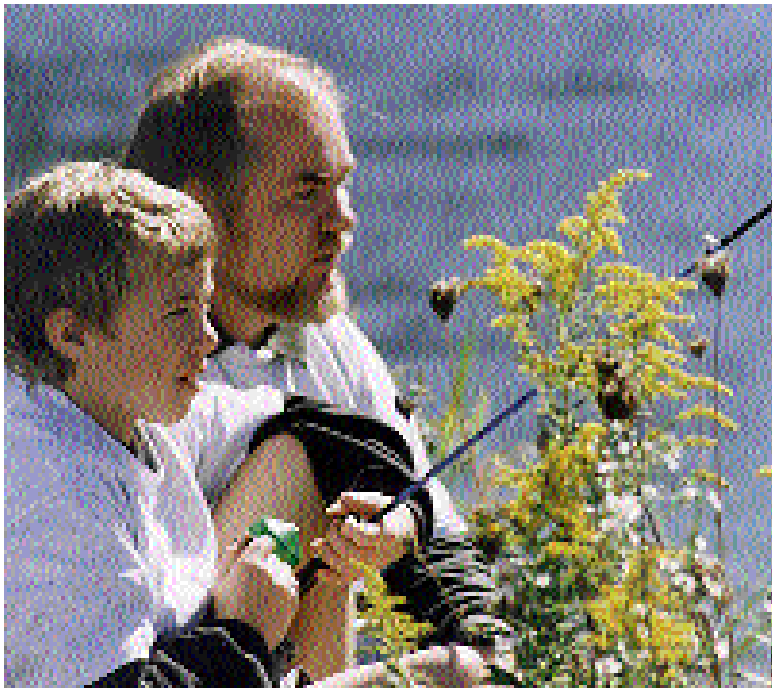
To place this in context, it helps to compare highways growth effect to other components. A method described in the appendix differentiates between the effects on Maryland's growth of an increased supply of labor and capital, and increased productivity of these factors. The growth of Maryland's workforce and investment in its capital stock explained 56 percent of growth. The remaining economic growth is derived from productivity growth. As Figure 4 shows, highway investment explains fully 10 percent of productivity growth, or 4 percent of total growth.

Conclusions

Highway investment delivers two significant benefits to Maryland's economy. It supports economic activity and employment through purchases of labor and goods and services from workers and firms in the state. This study has shown that each dollar spent between 1991 and 1996 supported on average nearly three dollars of output, or 2.0% of the state's product. The corresponding employment, 1.2% of Maryland's workforce, represented an average 25 jobs per million dollars spent.

Highway investment also promotes economic growth by raising productivity in the private sector of the economy. The study has found that between 1982 and 1996 a dollar's highway investment yielded an average 17 cents in private savings; the implied 17 percent return exceeds the return to private capital on all standard estimates.

Apart from its direct impact on the quality of life, then, highway spending is a substantial factor in present prosperity and an important source of future growth. When Marylanders spend money on their highway system, they are also investing in the broader economy, today's economy and tomorrow's.



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